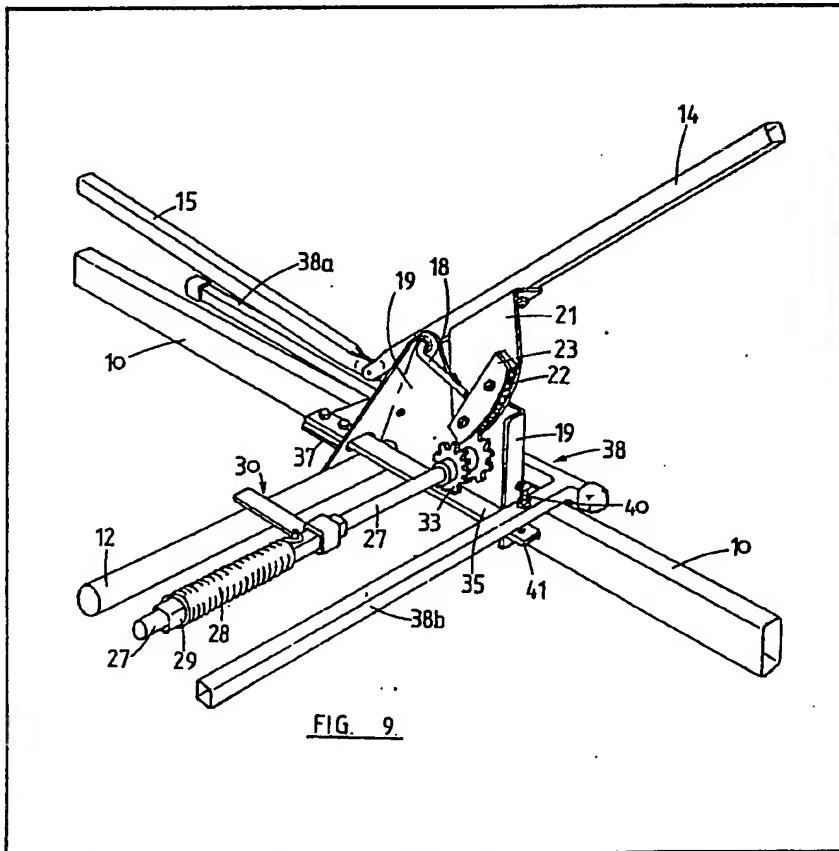


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(54) Improvements in and relating to  
adjustable beds

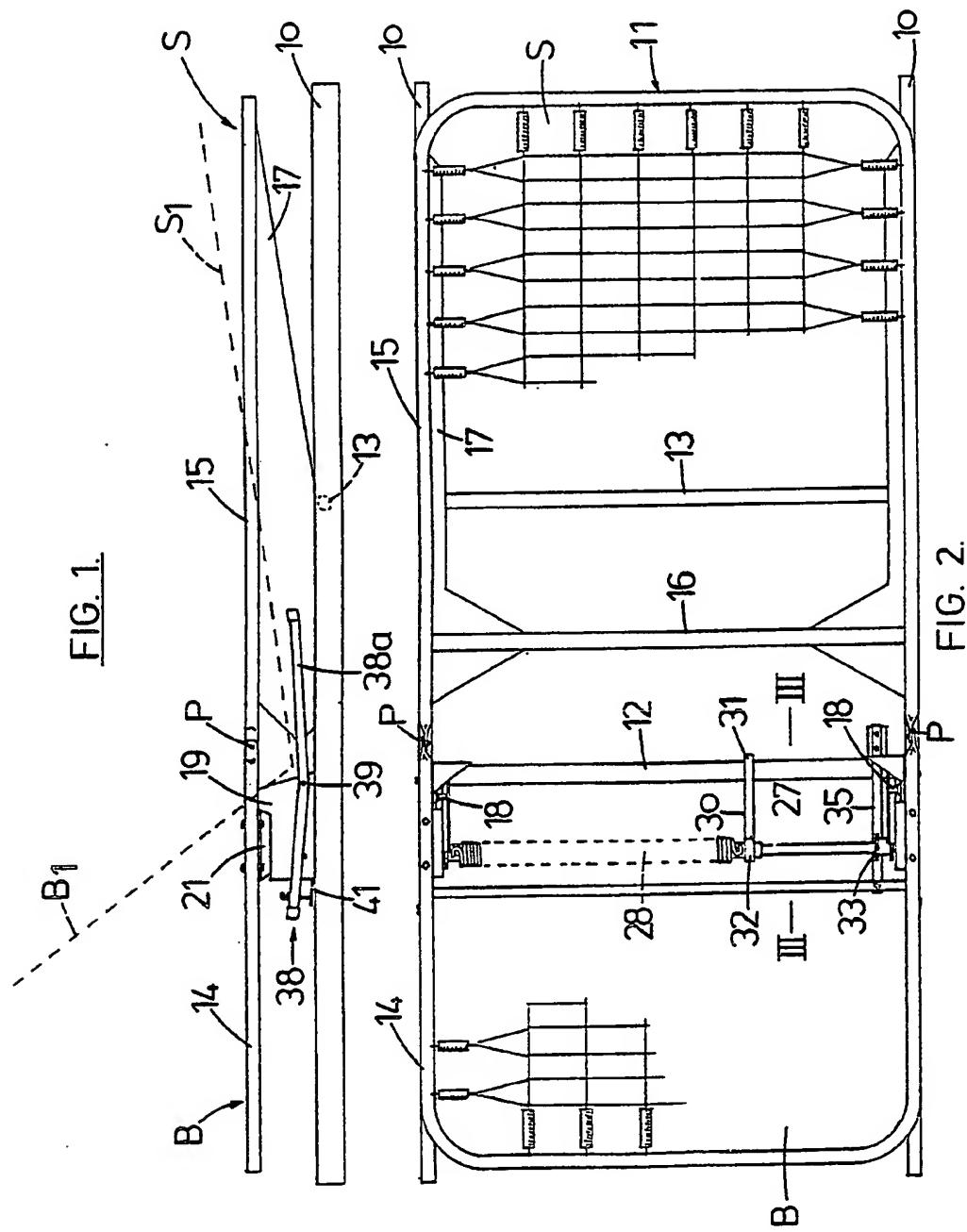
(57) A bed under frame 10 supports a mattress frame composed of two pivotally interconnected sections 14,15, wherein the section 14 is pivoted to bracket 19 on the frame 10 by hinge pin 18, and is controlled by a sector shaped rack 22 meshing with a pinion on a torsion spring-driven shaft 27; the shaft being detained in any desired position by the engagement of the teeth of a secondary pinion 33 in apertures in a leaf spring 35, which spring may be removed from engagement with said secondary pinion by the rocking of a frame 38, 38b. The spring 28 urges the member 14 to the upright position, and force (eg patients weight) applied to lower member 14 rewinds the spring.



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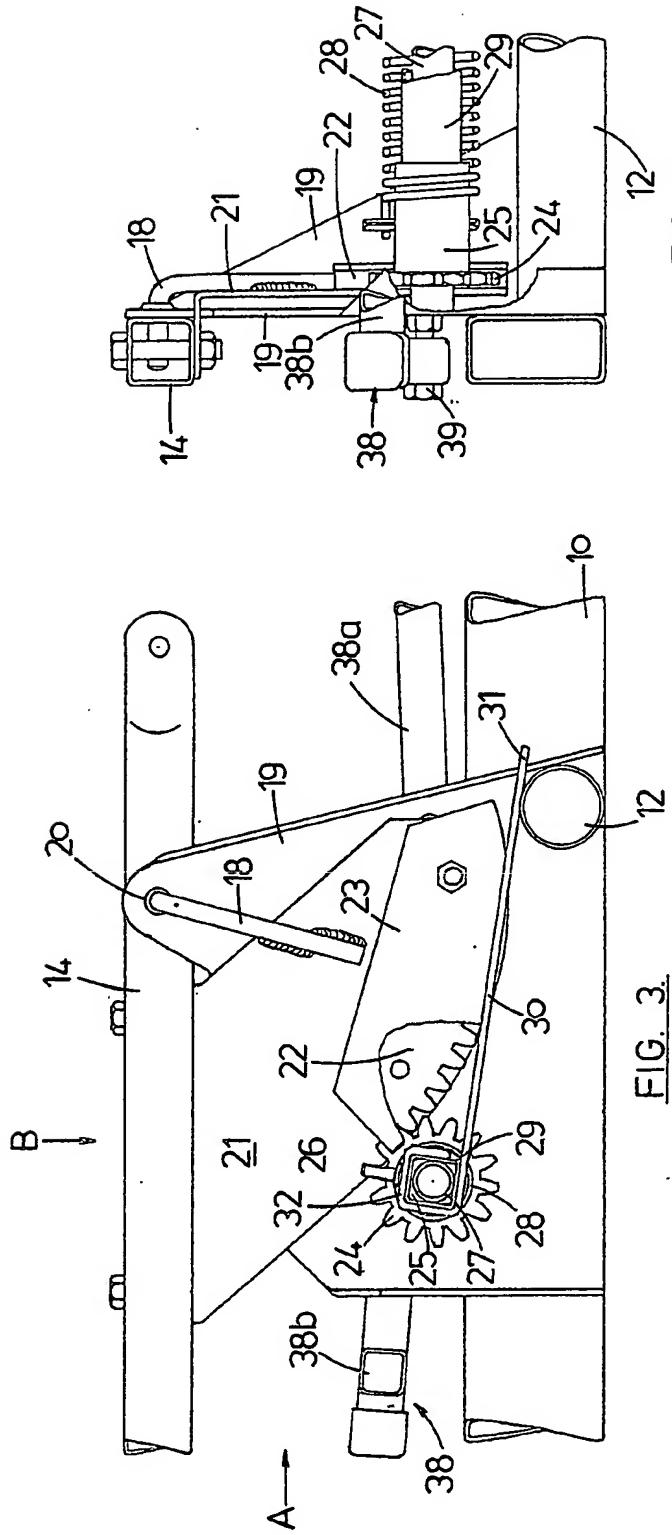
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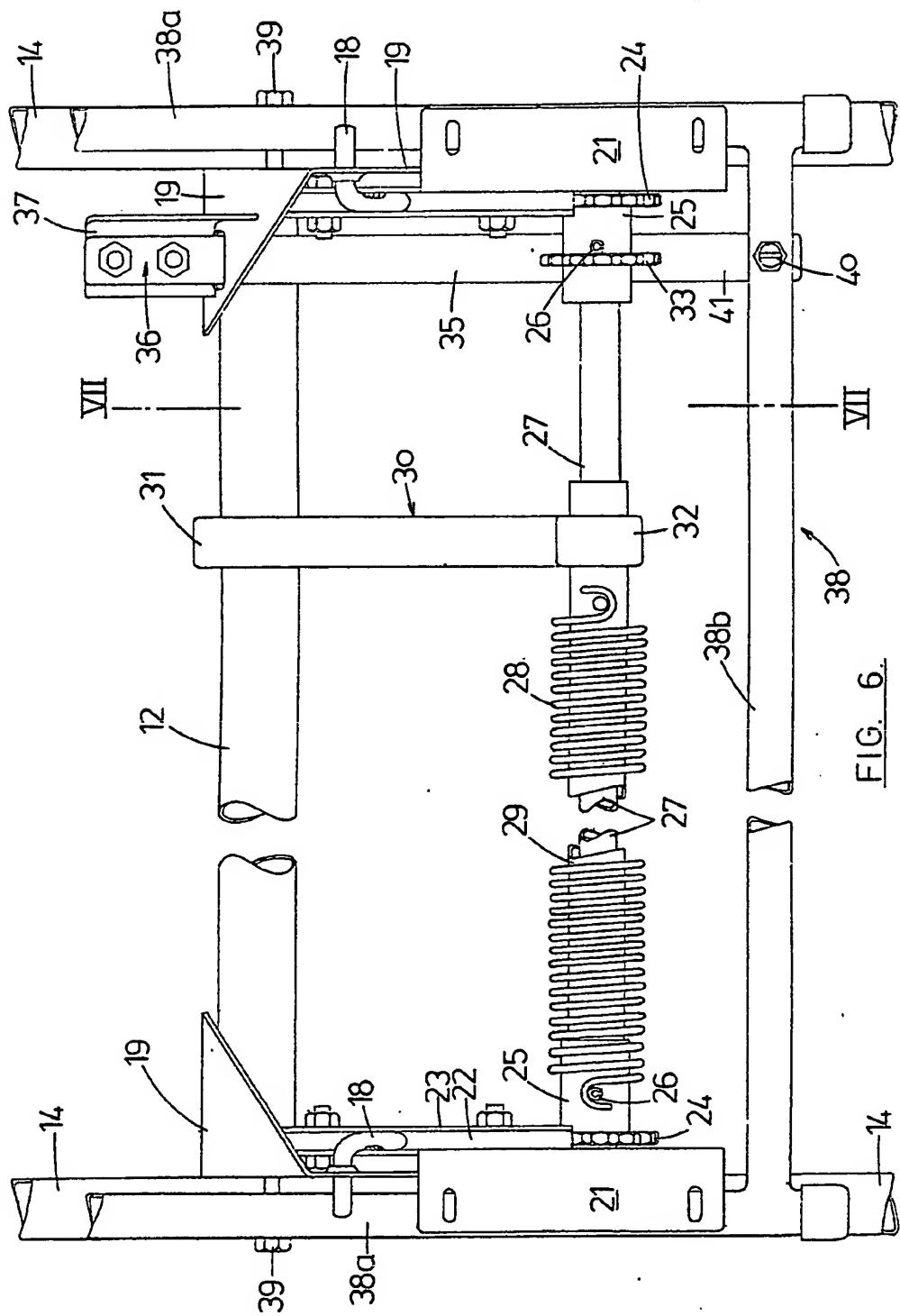


FIG. 6.

6 3 0 4 5 9 2  
1 2 3 8 9 0 1  
6 7 8 9 0 1 2

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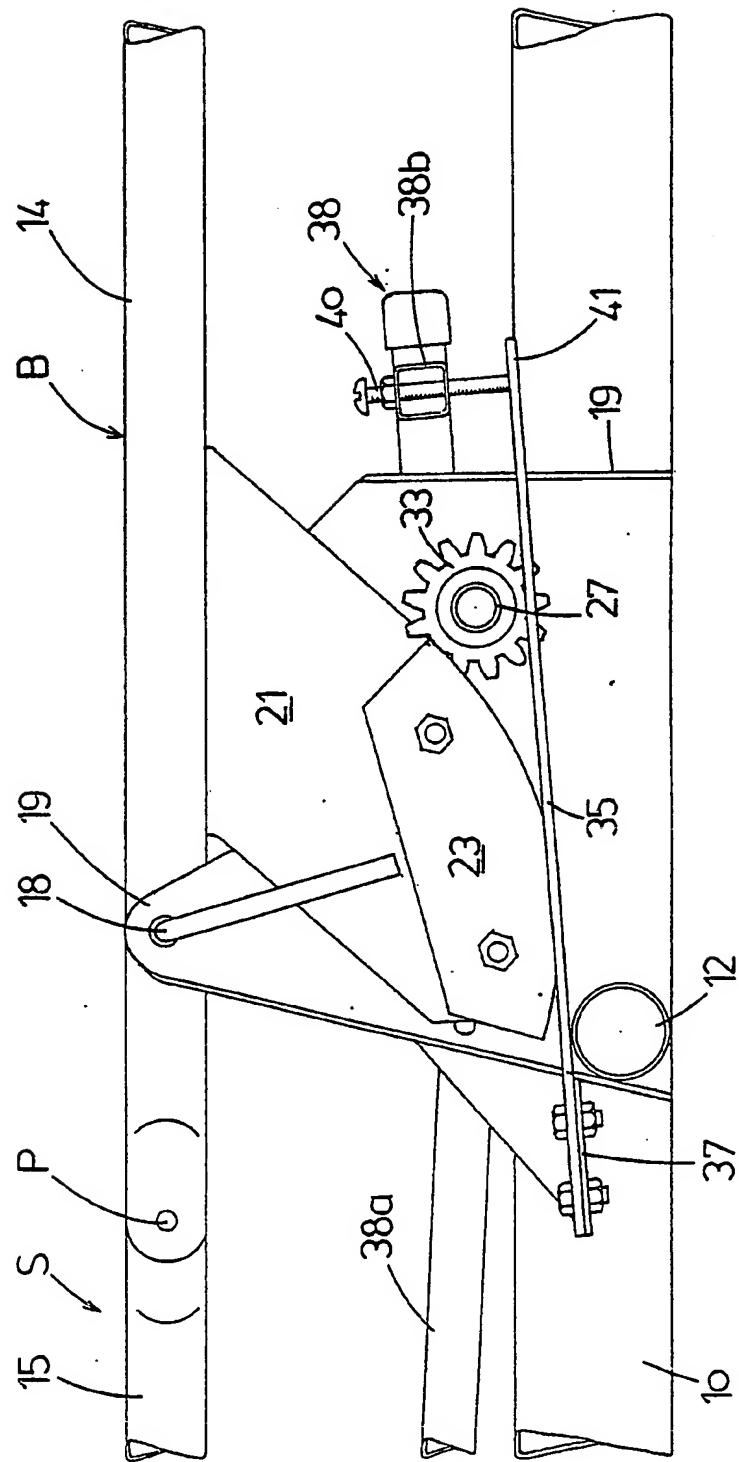


FIG. 7.

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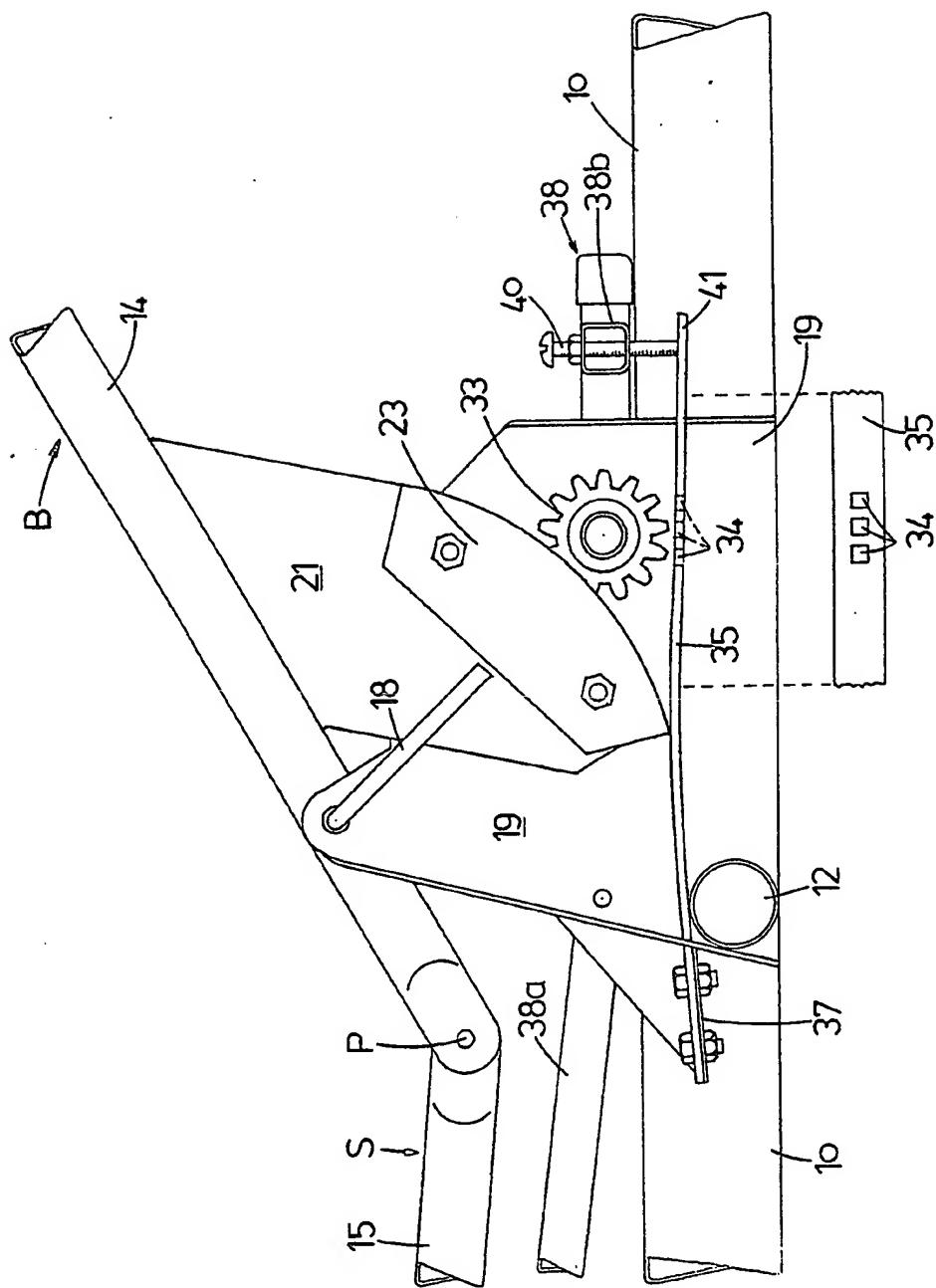


FIG. 8.

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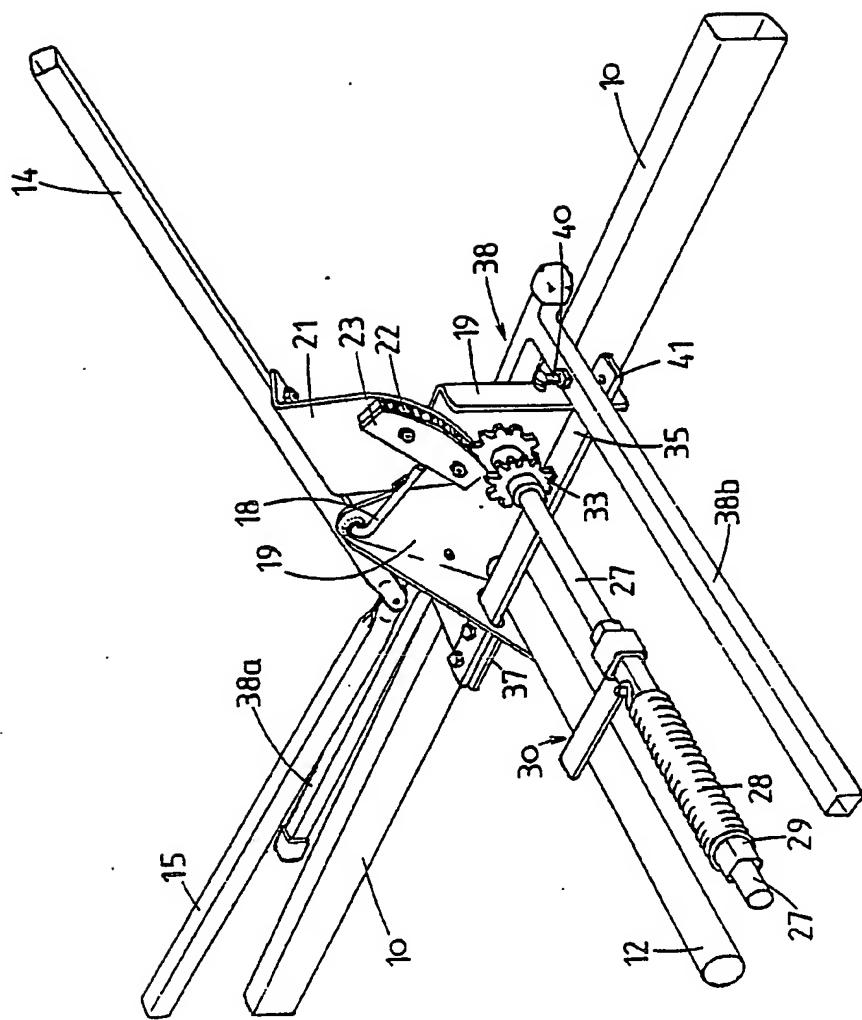


FIG. 9.

**SPECIFICATION****Improvements in and relating to beds**

5 This invention relates to a bed.  
 It is well known to provide a bed with a mattress support which can be adjusted in shape so that the occupier of the bed can be supported in a range of positions from supine through several degrees of  
 10 recline to seated. To facilitate this adjustment the mattress support is articulated so that when adjusted it forms a back rest and seat section. This type of bed can form a luxury bed or recliner for those people who enjoy reading in bed but more  
 15 importantly it can be used for those people with medical or physical disabilities that require that they be fully or partially confined to bed.

A current trend with hospitals is that a patient be nursed within his own home by community or  
 20 extramural nursing. In this way valuable bed space in the hospitals can be readily made available once a patient is well enough to be moved to his own home. In such a situation the hospitals supply the medical requirements, possibly daily nursing labour and  
 25 linen etc. via mobile services. In this situation the patient has the comfort, security and privacy of his own home, however, he does not have a nurse on immediate call to adjust his posture in bed.

30 A serious problem often develops when people are confined to bed for long periods. This is the development of bed sores or pressure sores and these develop on the load bearing areas of a person's skin. This condition can be intensified in some areas of the human body such as the heels due to a  
 35 seated patient's constant need to resist the tendency to slip downwards toward the foot end of the bed. It has been found that regular changes of position, posture or inclination have the effect of redistributing the patient's weight thereby shifting pressure  
 40 points and this contributes substantially to the prevention of pressure sores.

The object of the present invention is to provide a bed which has an articulated mattress support with a control mechanism whereby the articulation of the  
 45 mattress support can be carried out by adjustments made by the occupier of the bed.

In its broadest aspect the invention provides a bed comprising a frame, a mattress support formed by first and second support sections hingedly coupled  
 50 together, said first support section being pivotally coupled to said frame at a point between its free end and pivotal coupling to said second support section, a drive shaft mounted for rotation on said frame, torque producing means coupled to said shaft, drive  
 55 transfer means which in use translate rotational movement in the shaft into pivotal movement of the first support section relative to the frame and vice  
 versa, locking means to prevent rotation of said shaft and control means which in use release said shaft to  
 60 either permit rotation thereof by said torque producing means so as to pivot the free end of said first support section away from said frame or permit rotation of said shaft by pivotal movement of said first support section toward said frame.

65 Preferably the bed is also provided with means

which tilt the second support section relative to the frame in response to the pivotal movement of the first support section relative to the frame.

In a preferred form of the invention the torque  
 70 producing means is provided by a helical torsion spring which surrounds the drive shaft, is coupled at one end to the shaft and at its other end reacts against the bed frame structure. The drive transfer means can be provided by a spur gear mounted on  
 75 the shaft and coupled to a toothed quadrant mounted by said first support section. The control means can, in such an arrangement, be provided by a second spur gear mounted on said drive shaft and engageable in one or more openings provided in a lever arm mounted by said frame. The lever arm can be coupled to a release bar which extends transversely across the frame so as to be accessible at either side of the bed.

To more fully described the invention reference  
 85 will be made to the accompanying drawings in which:-

Figure 1 is a side elevational view of the bed according to the invention,

Figure 2 is a plan view of the bed as shown in

90 Figure 1,

Figure 3 is a partial cross section taken on the line III-III,

Figure 4 is a view taken in the direction of arrow A as shown in Figure 3,

95 Figure 5 is a plan view taken in the direction of arrow B of Figure 3,

Figure 6 is a partial plan view of the bed as shown in Figure 1,

100 Figure 7 is a cross sectional elevation view taken on line VII-VII of Figure 6,

Figure 8 is a similar Figure to Figure 7 but showing the control mechanism in the released position, and

Figure 9 is a perspective view looking toward the end of the drive shaft as illustrated in Figures 7 and

105 8.

Referring firstly to Figures 1 and 2 the support frame is provided with side rails 10 which are connected together by cross tubes 12 and 13. These side rails 10 would usually have a head end and foot end attached at their extremities. This frame supports the mattress support 11 which has a seat section S and a back section B. Seat section S is conveniently formed by a side rail 15 which is of U-shape with the ends of the legs thereof coupled to the ends of the  
 110 U-shape side rail 14 of the back section B. The seat section S is suitably stiffened and braced by spreader bar 16 and sheet metal skirts 17. The back section B is supported on a pivot pin 18 at each side and the skirt 17 of the seat section S rests on cross tube 13. The seat section S could be mounted in other ways for example a link from cross tube 13 to the frame 15 of the seat section S.

In the illustrated embodiment the overall length of the total mattress support surface is two metres. The pivot point P coupling the seat and back sections is 695mm from the extremity of the U-shape that forms the back section B whilst the back rest pivot 18 is 695mm from this point. A suitable position to support the seat section S is 1250mm from the head end. The width of the mattress support section can

be as little as 790mm but normally is in the order of 915mm.

A mounting bracket 19 is fixed to and extends upwardly from each side rail 10 and as illustrated 5 can be integral with the cross tube 12. A hole 20 is provided at the top of brackets 19 to provide an opening for the pivot 18. This pivot 18 is conveniently provided by a generally L-shape pin which has one end extending through opening 20 and into 10 side rail 14 of back section B and the other end welded to a mounting plate 21 extending from said side rail 14.

The mounting plate 21 carries at its lower extremity a lamination consisting of a toothed quadrant 22 15 and a cover plate 23. The toothed quadrant 22 describes an absolute radius from the centre of pin 18. Engaging with the toothed quadrant 22 is a spur gear 24 which is mounted on a boss 25 which in turn is tension pinned by pin 26 to a drive shaft 27.

20 The drive shaft 27 extends transversely across the frame 10 and is rotatably mounted by short removable stub axles (not shown) in the mounting brackets 19. Accordingly as the back section B is pivoted away from frame 10 by an angle of movement of 50° the 25 drive shaft 27 rotates approximately three quarters of a turn.

A helical torsion spring 28 surrounds the drive shaft 27 with one end hooked to the shaft adjacent to spur gear 24 and the other end is hooked to a square 30 tube sleeve 29. The sleeve 29 is a loose fit on the drive shaft 27 and acts as a spacer to prevent the spring spiralling under tension. Slid over the free end of this sleeve 29 is a torque bar 30 the outer end 31 of which rests on cross tube 12. The inner end 32 35 is bent to surround the sleeve 29 with sufficient clearance to provide a free sliding fit. This arrangement allows spring pressure regulation by gripping some part of the free end of the sleeve 29 with a spanner, sliding the torque bar 30 to one side, 40 increasing or decreasing spring pressure by rotating the sleeve 29, by say a quarter or a turn, then replacing the end 32 of torque bar 30 on the sleeve 29.

Referring now to Figure 9 of the drawings the right hand side of the mechanism is illustrated and this is 45 identical to the left hand side except for the addition of the locking and control means. An additional spur gear 33 is provided and this is mounted on the boss 25 of spur gear 24. The three lowest teeth of the spur gear 33 engage in three square holes 34 (see Figures 50 7 and 8) in a latch plate 35. This latch plate 35, which is conveniently formed from a length of hardened spring steel, is fixedly mounted at 36 to a landing 37 formed as part of mounting bracket 19. While the latch plate 35 is engaged with the latch gear 33 as 55 shown in Figures 7 and 9 rotation of the drive shaft 27 is prevented.

Referring to Figure 6 a release bar 38 is illustrated and is shown as a substantially U-shaped tubular member which is pivotally mounted to the two 60 mounting brackets 19 by a pivot bolt 39. The legs 38a of the release bar 38 are bent slightly so that the pivot point 23 becomes the lowest point and the extremities are raised slightly in relation to this pivot point 23 (see Figure 1). The cross member 38b 65 of the release bar 38 has one tapped hole into which

is fitted an adjusting screw 14 and is located directly above the free end 41 of latch plate 35.

- Except for Figures 8 and 9 of the drawings the bed is illustrated in the supine position with back section 70 B and seat section S being in the same plane, which plane is generally parallel to the plane of the frame members 10. The back section B can be raised to the position B<sub>1</sub> shown in Figure 1 and this results in the seat section S tilting to the position shown as S<sub>1</sub> due to the interaction of the skirt 17 with cross tube 13. The mattress support 11 is locked in the supine position due to the latch plate 35 engaging in a locking arrangement with the spur gear 33 thus preventing shaft 27 from rotating.
- 75 The mattress support 11 can be articulated by the occupant of the bed with the articulation being carried out by the occupant's own body weight and the helical torsion spring 28. To achieve this movement the occupant can grasp the end which projects to the 80 foot of the bed of either leg 38a of release bar 38. By drawing to leg 38a upwardly the cross bar 38b moves downwardly so that the adjusting screw 40 pushes downwardly the free end 41 of latch bar 35 thus moving openings 34 away from spur gear 33.
- 85 The shaft 27 is thus able to rotate under the torque produced by spring 28. The torque applied to the shaft 27 is transferred to the back section B by spur gear 24 engaging in quadrant 22. The configuration of the latch gear 33, latch bar 35 and release bar 38 90 clearly illustrated in Figure 8 of the drawings. When the required angle of inclination of the back rest section B has been attained the release bar 38 is released thereby engaging the three lowermost teeth of spur gear 33 in the opening 34 in latch bar 35 (see Figure 9).
- 95 The back section B control mechanism thus locks the back section B in the selected incline position and holds it against the occupant's weight. When the mattress support 11 is in the supine position the 100 control mechanism holds in the opposite direction to counter the torque being applied to the shaft 27 by spring 28. The torque produced by the spring diminishes as the angle of elevation of the back section increases thus the initial torque of the spring.
- 105 The back section B control mechanism holds in the opposite direction to counter the torque being applied to the shaft 27 by spring 28. The torque produced by the spring diminishes as the angle of elevation of the back section increases thus the initial torque of the spring.
- 110 must be adjustable to suit the variations in load that can be caused by different weight of bedding material etc. This adjustment is as previously described easily carried out by the removable nature of the torque bar 30.
- 115 When the back section B is returned to the supine position the interengagement of spur gears 24 with quadrants 22 causes a rotation in shaft 27 which once again tensions the spring 28. Throughout the upward or downward movement of the back section 120 B the seat section S by being interconnected tilts at a different but relative rate to the back section B. The result is that whatever angle is selected for the back section B the seat section S angles sufficiently to counter any tendency for occupant to slip toward the foot end of the bed.
- 125 As a substantial proportion of the length of the back section B extends beyond the pivot 18 the weight of the occupant of the bed combines with the torque produced by the spring 28 to achieve the 130 articulation of the mattress support 11. The occupant

of the bed can thus readily adjust his posture in bed without the need of any outside assistance as the control lever formed by release bar 38 is close to hand and a controlled raising or lowering of the back section B is achieved by the spring pressure and the occupant's own weight. The occupant is thus able to adjust his posture while occupying the bed so frequent posture changes are encouraged by the ease of operation. This allows the occupant to regularly change his position, posture or inclination with the result that there is a redistribution of the patient's weight thereby shifting pressure points and contributing to the prevention of pressure sores.

#### CLAIMS

15. 1. A bed comprising a frame, a mattress support formed by first and second support sections hingedly coupled together, said first section being pivotally coupled to said frame at a point between its free end and its pivotal coupling to said second support section, a drive shaft mounted for rotation on said frame, torque producing means coupled to said shaft, drive transfer means which in use translate rotational movement of the shaft into pivotal movement of the first support section relative to the frame 20 and *vice versa*, locking means to prevent rotation of said shaft and control means which in use release said shaft to either permit rotation thereof by said torque producing means so as to pivot the free end of said first support section away from said frame or 25 permit rotation of said shaft by pivotal movement of said first support section toward said frame.
2. The bed according to claim 1 further including means to tilt the second section relative to the pivotal movement of the first support section relative to the frame.
3. The bed according to claim 1 or 2 wherein the drive transfer means comprises at least one spur gear mounted on said shaft, said spur gear intermeshing with a toothed quadrant mounted by said 40 first support section.
4. The bed according to claim 3 wherein the arc of said toothed quadrant is coaxial with the pivot axis of said first support section with said frame.
5. The bed according to claim 3 wherein a bracket projects upwardly from each longitudinal side of said frame, a pivot arm extends from said bracket and is fixedly coupled to said toothed quadrant which projects downwardly from a longitudinal member of said first support section.
50. 6. The bed according to any one of the preceding claims wherein the torque producing means is a helical torsion spring.
7. The bed according to claim 6 wherein the helical spring is located about a sleeve which is mounted on said shaft, one end of said spring being attached to a torque pin projecting from said shaft.
55. 8. The bed according to claim 7 wherein the other end of said spring is pinned to said sleeve, there being a torque arm mounted on said sleeve and engaging with a fixture of said frame.
9. The bed according to any one of the preceding claims wherein said locking means comprises a spur gear mounted on said shaft, at least one tooth of said spur gear being engagable in an opening provided in 60 a lever arm mounted by said frame.

10. The bed according to claim 9 wherein said arm is coupled to a release bar extending transversely across said frame, said release bar having an operating lever on at least one end thereof to be 65 located at the side of the bed and accessible to a person when in said bed.
11. The bed according to claim 10 wherein said release bar has an operating lever at each end thereof, said release bar being adjustably coupled to the free end of said lever arm, each operating lever being pivotally mounted in its length to the frame.
12. A bed substantially as herein described with reference to the accompanying drawings.

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